FACT SHEET

Harmful Algal Blooms: Monitoring

OCTOBER 20, 2014

KENTUCKY DEPARTMENT FOR ENVIRONMENTAL PROTECTION

Monitoring

Harmful Algal Bloom (HAB) monitoring of Kentucky lakes is performed May through October which coincides with both the growing and recreational seasons. Although elevated cyanobacterial cell counts may occur throughout the year, the largest blooms are usually found in late summer. Additionally, the typical genus of cyanobacteria tends to change from winter to summer with summer populations more commonly comprised of cyanobacteria with known abilities to produce toxins. For these reasons Division of Water focuses much of its monitoring during July and August.

In 2013, the Louisville office of the US Army Corps of Engineers began monitoring five USACE reservoirs in Kentucky, using cells counts of cyanobacteria, or blue-green algae and the Division of Water monitored HABs in 14 susceptible, non-USACE lakes to determine the condition of those lakes. The Louisville office of the USACE continued to monitor their reservoirs through the winter of 2013-2014 and elevated blue-green algae cell counts were persistent through the cold weather months. As spring and summer approached in 2014, those algal counts increased in continued monitoring. The Division of Water began lake monitoring efforts again in July of 2014 with 18 lakes being monitored for cyanobacteria.

Results

When cell counts exceed the 100,000 cells per milliliter guideline described in Standards, a recreational advisory is issued for the respective reservoirs regarding recreational contact with the water. The Public Water Systems affected by these advisories are listed under Affected Public Water Systems. In 2013 the U.S. Army Corps of Engineers issued recreational advisories for all five lakes that were monitored (Taylorsville Lake, Barren River Lake, Green River Lake, Nolin River Lake and Rough River Lake). The latter four of the five USACE reservoirs also serve as public water supply sources that serve over 200,000 Kentuckians. The Division of Water issued recreational use advisories for six non-Corps reservoirs (Beaver Lake, Guist Creek Lake, Lake Reba, Wilgreen Lake, General Butler, and Willisburg Lake) based on 2013 monitoring, two of which serve as public water supply sources (Guist Creek and Willisburg). As of October 8, 2014, there are currently advisories at the same five USACE lakes and 11 non-USACE lakes in Kentucky (Beaver Lake, Carpenter Lake, Greenbrier Creek Lake, Guist Creek Lake, Reformatory Lake, McNeely Lake, Campbellsville City Reservoir, General Butler State Park Lake, Long Run Lake, Lake Reba, and Willisburg Lake).

Methods

Lakes monitoring consists of assessing clarity (using Secchi disk), water quality (including nutrients and dissolved oxygen), Chlorophyll a analysis, and blue-green algae cell counts. Blue-green algae blooms also produce cyanotoxins, such as microcystin. Some cyanotoxins can be very harmful to animals and humans if ingested. The concentration of cyanotoxins, like microcystin, cannot be determined using cell counts because cyanobacteria do not always produce these compounds. The Division of Water is developing protocols as to where and when to conduct testing for toxins associated with HABs which may present an elevated risk to human health. These protocols include consideration of the type and severity of the HAB, the potential for exposure of people to the HAB (e.g. swimming beaches, other recreational areas), and whether a drinking water source may be affected by the HAB.

Analysis

Toxins can be measured using two methods. Immunoassay (ELISA) is one method to analyze for levels of toxins. The Division of Water is looking into using ELISA methods to assess the levels of cyanotoxins within HABs. Mass Spectrometry with Liquid Chromatography or electron ionization-gas chromatography methods can also be used to analyze for the levels of toxins occurring within a HAB. The Division of Water is assessing the need for this type of analysis and the costs to conduct this analysis.

In addition, The Division of Water is working with USACE, EPA's Office of Research and Development, Ohio EPA, the University of Cincinnati, NASA, and others to develop predictive models using water quality in combination with hyper spectral data and multispectral imagery from Landsat. Initial results of this data analysis indicate that the predicted modeled values were well correlated with measured values. These models have expanded the division's ability to identify lakes or portions of lakes that are likely to have HABs where it is not feasible for the division to monitor, as well as identifying lakes for priority monitoring. These tools also allow the division to identify lakes where HABs do not appear to be a concern.

Standards

The World Health Organization has established a recreational waters guideline based on moderate probability of adverse health effects. This guideline is based on the potential for short-term adverse effects including skin irritation and gastrointestinal illness. If blue-green algae cell counts are above 100,000 cells/ml, the Division of Water issues a HAB advisory. In addition to cell counts, regulatory requirements or guidelines are being evaluated for drinking water or recreational use of water because of the presence of irritants and toxins associated with HABs. Microcystin, a hepatotoxin produced by *Microcystis* and some other cyanobacteria, is the only HAB toxin for which sufficient information exists to formulate a guideline. Increased monitoring of public drinking water should occur whenever microcystin levels reach 1 ppb (parts per billion, or micrograms/liter, or µg/L). Potential risk to human health from recreational contact is considered low at microcystin concentrations up to 4 ppb and moderate at 20 ppb. Most public water systems and health agencies rely on the World Health Organization's (WHO) guideline of 1.0 ppb for microcystin LR. As there is no federal regulation or established limits, states have set their own: Ohio, Oregon and Oklahoma have a limit of 1 ppb for microcystin-LR, while Florida's is at 10 ppb. Other countries have set standards as well; for example, Australia has proposed a limit of 1.3 ppb for total microcystin and Canada has set the threshold at 1.5 ppb. Six states have developed guidelines for at least one of the other cyanotoxins.

Currently the USEPA does not have drinking water Maximum Contaminant Levels for algal toxins. However, three (3) toxins are on the Candidate Contaminant List 3 (CCL3): anatoxin-a, microcystin-LR and cylindrospermopsin. EPA has also indicated that these three (3) toxins will be included in the Unregulated Contaminant Monitoring Rule 4, currently scheduled for a 2016 release. In the absence of a regulatory threshold, Kentucky is relying on thresholds used by the World Health Organization and other states to guide its advice to the general public using waters for recreating, and to public water systems, and consumers. The Division of Water has engaged EPA to request their assistance with this emerging problem.

Affected Public Water Systems

A number of the lakes with advisories serve as sources of drinking water, including Taylorsville Lake, Rough River Lake (Grayson County Water District), Barren River Lake, Nolin River Lake (Edmonson County Water District), Green River Lake, Greenbrier Creek Lake, Guist Creek Lake (Shelbyville Water and Sewer Commission), Campbellsville City Reservoir (Campbellsville Municipal Water), and Willisburg Lake (Springfield Water Works). The Division of Water is working with the public water systems using these lakes (Leitchfield Water Works, Glasgow Water Company, Scottsville Water Department, Columbia/Adair County Regional Water Commission and Mount Sterling Water Works) to advise them of the condition of their source water regarding HABs. Public water systems are not currently required under the Safe Drinking Water Act to monitor the source water for cyanotoxins at this time. However, public water systems are required to monitor and treat taste and odor problems that can be associated with a HAB. Carbon filtering can be an effective treatment for low levels of cyanotoxins. The Division of Water has developed a technical guidance for treatment and management of untreated (raw) water and treated (finished) water for cyanotoxins. EPA also has available a Fact Sheet that describes effective treatment of water impacted by HABs.